DOCUMENT RESUME

ED 305 615 CS 009 618

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TITLE An Analysis of the Spellings of Young Children with Varying Levels of Phonemic Awareness.
PUB DATE Feb 89
NOTE 26p.; Paper presented at the Annual Meeting of the Eastern Educational Research Association (Savannah, GA, February 1989).
PUB TYPE Reports - Research/Technical (143) -- Speeches/Conference Papers (150)

EDRS PRICE MF01/PC02 Plus Postage.
DESCRIPTORS Grade 1; Grade 3; Multiple Regression Analysis; Phoneme Grapheme Correspondence; Phonemes; Primary Education; *Spelling; Spelling Instruction
IDENTIFIERS *Phonemic Awareness; *Spelling Growth

ABSTRACT

To examine the effects of phonemic awareness (defined as "conscious access to the phonemic level of the speech stream and some ability to cognitively manipulate representations at this level") on spelling development and to explore the relationship of phonemic awareness to recognized stages of spelling development, a study collected data on 96 first-grade students and 87 third-grade students attending public school in southeast Texas. Children in both grades received traditional reading instruction from basal reading series reflecting a whole-word approach to initial reading instruction. All children in the study spelled the same set of 40 words. Phonemic awareness was measured using the GKR Test of Phonemic Awareness, an oral test consisting of six subtests--phonemic segmentation, blending, deletion of first phoneme, deletion of last phoneme, substitution of first phoneme, and substitution of last phoneme. Word specific information was measured using a test containing 60 two-alternative, forced-choice items. One alternative was a correct spelling for the word. The other was a phonetically legitimate though incorrect spelling. Children were instructed to circle the correct spelling for each word as it was pronounced by the researcher. Findings suggested that in first-graders, phonemic awareness had a more powerful effect, indicating that spelling at this level is more of a sequential, encoding process. By third grade, word-specific information exerted stronger influence on spelling, suggesting that children at this level spell using memorized associations. (MM)

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An Analysis of the Spellings of Young Children With Varying Levels of Phonemic Awareness

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Paper presented at the annual meeting of the Eastern Educational Research Association, Savannah, Georgia, 1989

CS009618

An Analysis of the Spellings of Young Children
with Varying Levels of Phonemic Awareness

Phonemic awareness is a term that has begun to appear in the reading research literature within about the last decade. Phonemic awareness has been defined as "conscious access to the phonemic level of the speech stream and some ability to cognitively manipulate representations at this level" (Stanovich, 1986, pp.362) (e.g., playing "Pig Latin" requires manipulation of phonemes). This definition implies that phonemic awareness involves both insight and skill.

A substantial amount of evidence has begun to accumulate to indicate there is a relationship between phonemic awareness and early reading ability (Juel, Griffith, & Gough, 1986; Liberman, 1982; Stanovich, 1986; Torneus, 1984; Tunmer, 1986; Tunmer, Herriman, & Nesdale, 1988) and some evidence to support a causal connection between the two (Bradley & Bryant, 1983; Lundberg, Frost, & Petersen, 1988).

Less investigation has been done into the relationship between phonemic awareness and spelling ability, although at least one study found phonemic awareness to be a powerful, albeit indirect, factor in the growth of spelling ability in the first two years of schooling (Juel, Griffith, & Gough, 1986), and a second (Lundberg, Frost, & Petersen, 1988) showed a causal connection between phonemic awareness training and learning to spell in school. In the Juel et al. (1986) study the results from a path analysis indicated that phonemic awareness affected the development of spelling ability in first and second grade children through its influence on the acquisition of letter-sound correspondence knowledge.

Lundberg et al. (1988) provided metalinguistic training to kindergarten children (average age 6 years) in Denmark, with the aim of guiding discovery of and attention to the phonological structure of language. A control group

followed the regular preschool program which in Denmark emphasizes social and aesthetic aspects of development. At about 7 months into first grade and again at the start of the second grade the children's spelling and reading ability was tested using a list of 28 words selected from a pool of frequently used primers in Denmark. In first and second grade the children in the training group performed significantly better on the spelling test than did the children in the control group.

The relationship that exists between phonemic awareness and spelling is a consequence of the nature of written English. English is characterized as an alphabetic script. Its written words are composed of sequences of letters which roughly correspond to the phonemes of spoken words. When children learn to spell they must grasp this principle in order to internalize orthographic patterns that represent spoken words.

Linguists (Chomsky & Halle, 1968) have described the mental lexicon as containing abstract word units. Facets of these word units include phonological, syntactic, semantic, and orthographic information that is associated with each word. Phonological, syntactic, and semantic information about individual words is acquired through the process of developing spoken language. Acquisition of the ability to spell (and read) words requires the integration of the fourth type of information, information about the orthographic representation of the word (i.e., the spoken word's written symbols) in print (Ehri, 1980).

Ehri (1980) has used the term amalgamation to denote the manner in which a word's orthographic identify is established in lexical memory.

> Since beginners already know how words are pronounced, their task is to assimilate the word's printed form to its phonological structure. They do this by matching at least some of the letters to phonetic or phonemic segments detected in the word. These

> segments serve as 'slots' in lexical memory which are filled by images of letters seen in the word's spelling. (Ehri, 1980, p. 313)

Ehri believes that much of a child's orthographic information is induced as a consequence of experiences with print. What lies at the heart of this process may be the level at which a child has access to the phonological information associated with words in the mental lexicon. Being able to fill in phonemic segments with images of letters suggests the child must have access to words at the phonemic level.

Additionally, Frith (1980) has proposed a theory of reading by full or partial cues. Individuals reading by partial cues may not completely attend to the sequence of letters representing the phonological properties of a word, relying instead on context and some letters to recognize words. In contrast, individuals reading by full cues do complete an internal analysis of words they read. According to Frith, individuals using full cues to read also become better spellers. Children with phonemic awareness have the skills needed to complete the internal analyses of words (i.e., they can attend to words at the level of the phoneme).

Amalgamation theory focuses on an explanation of how spellings of words the child encounters in print are learned rather than on how the child acquires an ability to generate spellings for novel words (i.e., words not previously encountered in print). However, it is likely that the acquisition of individual-word spellings can result in the acquisition of information about the spelling of individual sounds. Conscious access to the speech stream, resulting in the ability to segment the sounds in words, allows the child to focus attention on the spellings of individual sounds <u>within</u> words. Perhaps, as orthographic images for words become stored, some information

about the letter-sound correspondences among individual phonemes is induced for later use when spelling novel words. Thus, phonemic awareness may have both a direct and an indirect effect on the acquisition of spelling ability. Because it facilitates a complete analysis of the graphic structure of words during reading, it directly affects the acquisition of orthographic information about specific words, in addition to its indirect effect through the acquisition of letter-sound correspondence information.

Phonemic awareness has been described as necessary but not sufficient for learning to spell. That is, while phonemic awareness facilitates the acquisition of spelling ability, there are other factors that also exert an effect. If the association between letters and phonemes formed perfect one-to-one correspondences, spelling English words would simply be a process of learning the letter-sound correspondences and generating spellings by sequentially associating sounds with letters. There would be no need to retain spellings for individual words. However, the correspondence between graphemes and phonemes is not one-to-one. In fact, various combinations of 26 letters spell the 44 sounds of English. For example, the phoneme /$\overline{oo}$/ can be spelled at least 9 different ways -- rude, move, fruit, group, moon, rue, rheumatic, grew, and canoe (Foss & Hakes, 1978). Clearly, spelling development is also dependent on remembering word-specific information, particularly in the case where the spelling of a phoneme in a word is equivocal. This study examines the strength of the direct effects of phonemic awareness coupled with memorized information about the spelling of specific words on the spelling ability of children in first and third grade.

In addition to examining the magnitude of phonemic awareness' effect on spelling development, this study also explores the relationship of phonemic

awareness to recognized stages of spelling development. Literature on invented spelling suggests a relationship between phonemic awareness and spelling. When producing invented spellings children assign letters to represent sounds in words. Facility with this task is enhanced by phonemic segmentation ability.

Method

Subjects

All first- and third-grade children who were attending public school in a town of approximately 7000 people in southeast Texas, and from whom parental permission was obtained were included in the study. The school district contained one K-2 school and one 3-5 school. Data were collected on 96 first-grade children and 87 third-grade children.

Children in both grades received traditional reading instruction from the Houghton-Mifflin basal reading series. This series reflects a whole-word approach to initial reading instruction. The first grade classrooms had three to four reading groups formed on the basis of the children's reading ability. In the third grade the children were also ability grouped and changed classes for reading.

Procedure

All children in the study spelled the same set of 40 words. Twenty of the words were chosen because they appeared in the preprimers of the basal series.

Phonemic awareness was measured using the GKR Test of Phonemic Awareness developed by Roper/Schneider (1984). This oral test has six subtests, each with seven items. It is administered individually. The subtests are phonemic segmentation, blending, deletion of first phoneme, deletion of last phoneme,

substitution of first phoneme, and substitution of last phoneme. The seven alpha coefficients, representing the average of all possible split-half reliabilities, are greater than .7 for all subtests. Details on test development can be found in Roper/Schneider (1984).

Word specific information was measured using a test containing 60 two-alternative, forced-choice items. One alternative was a correct spelling for the word. The other was a phonetically legitimate, albeit incorrect, spelling. Items testing the same spelling patterns were developed in pairs. Whenever a given spelling pattern was the correct response in one of the items, it served as the foil in the matching item (e.g., "tune, toon" was paired with "gune, goon"). The children were instructed to circle the correct spelling for each word as it was pronounced by the researcher. Transformations to adjust for guessing were made to each subject's raw score using a formula suggested in Allen and Yen (1979). Reliabilities computed using the K-R21 formula on the adjusted scores were .96 in grade 1 and .92 in grade 3.

Analysis of the Data

Multiple regression was used to determine the impact of phonemic awareness and word-specific information on spelling ability at each grade. Regression equations were formed with spelling as the dependent variable and phonemic awareness and word-specific information as the predictor variables. R^2's and standardized regression coefficients (beta weights) are reported.

Additionally, the relationship between phonemic awareness and word-specific information was plotted in scattergrams for grade 1 and grade 3.

A more in-depth analysis was made on the spellings produced by a subset of the original sample. Children in both grades who were either one standard deviation above (Grade 1>30, Grade 3>38) or below (Grade 1<10, Grade 3<26) the

mean on phonemic awareness were divided into high and low phonemic awareness groups. Five multi-syllabic words (hospital, community, contest, sandwich, appliance) selected from the original 40 were used for this in-depth analysis. Comparisons of the quality of spellings produced by these two groups were made.

A second qualitative analysis was made on the spellings produced by an additional subset of the first grade sample. Children who were in the high phonemic awareness group were further divided into "high phonemic awareness, high word specific-information" or "high phonemic awareness, low word-specific information" groups. Children one standard deviation above the mean on the word-specific information task were designated high on word-specific information. Children below the mean were designated as low on word-specific information. Four, one syllable words (when, this, what, duck) containing digraphs and an ambiguous vowel spelling were selected in order to examine the effects of word-specific information on the acquisition of less transparent letter-sound information.

Results

Table 1 presents descriptive data on all the measures. Table 2 gives the correlations among all the measures in each grade.

Regressions

Figure 1 shows the results of the regression analyses for both grades. In grade 1, 54 percent of the variance in the spelling scores was accounted for by phonemic awareness and word-specific information. At this level phonemic awareness is the more powerful predictor of spelling ability. The standardized regression coefficient indicates that in grade 1 spelling increases .56 of a standard deviation for each standard deviation increase in

phonemic awareness compared to a .21 standard deviation increase for each standard deviation increase in word-specific information.

In grade 3, 70 percent of the variance in spelling scores was accounted for by the two variables. By grade 3 word-specific information appeared to exert the more powerful influence, as indicated by the standardized regression coefficients (word-specific information = .68 whereas phonemic awareness = .27).

Scattergrams

Figures 2-3 show the relationship between phonemic awareness and word-specific information in each grade. In both first grade and third grade the shapes of the scattergrams suggest that phonemic awareness has a facilitative effect on the development of word-specific information. While children may perform well on the phonemic awareness test and poorly on the word-specific information measure, children tend not to score highly on word-specific information in the absence of phonemic awareness.

Qualitative Analyses

Figures 4-8 list the various spellings of the five multi-syllabic words produced by the high and low phonemic awareness groups in each grade.

A count was made of the salient consonant phonemes correctly or logically (according to invented spelling standards) represented in the incorrect spellings of these five words. For example, the phonemes represented by the letters "s," "n," "w," and "ch" were considered salient in the word sandwich. Table 3 reports the results of this analysis. In each grade, children in the low phonemic awareness groups represented fewer of the word's consonant sounds than did children in the high phonemic awareness groups.

In general it appears that the lowest phonemic awareness children (i.e., in grade 1) were less likely to complete an analysis of the words they attempted to spell. They seemed to be using some letter-sound associations in combination with a letter name strategy to spell words. For example, one low phonemic awareness first grader spelled sandwich "sewh." This child was able to correctly represent the phoneme /w/; the phoneme was spelled with a "w" rather than the letter "y," whose name sounds more like the pronunciation of the /w/. But, the child reverted to a letter name strategy to spell /ch/ (i.e., /ch/ sounds like aich, the name for the letter "h"). Although, this child attempted to represent the vowel in this spelling of sandwich, other children in the lowest phonemic awareness group did not represent vowels in their spellings (e.g., hspt, hs, h, or hptl for hospital and k, kt, kmt, cmnt for community).

In contrast, children in the two high phonemic awareness groups tended to spell more words correctly. They appeared to be attempting a more complete analysis of the words they spelled, as indicated by their tendency to represent vowels in the syllables beyond the first syllables in the words. In addition, a tally was made of the number of incorrect spellings that, when pronounced, sounded like the target word. Low phonemic awareness children rarely (i.e., N=1 spelling) produced such spellings.

The final qualitative analysis was of the spellings of first grade children who were high in phonemic awareness and either high or low in word-specific information. Six children were in the low word-specific information group; 5 were in the high group. The compilation of these data appears in Figure 9. From these data it appears that phonemic awareness is not sufficient when the spelling task requires more than a sequential matching

of sounds and symbols (e.g., in cases where the sound-symbol match is equivocal or where one sound is typically represented by several letters). When spelling words such as these, children high in phonemic awareness were able to represent all of the phonemes in the words, but children in the low word-specific information groups appeared not to have memorized spellings of equivocal phonemes.

Discussion

The regression analyses for both grades show that significant amounts of variance (i.e., >50%) in spelling scores can be explained by phonemic awareness and word-specific information. The relationship between these two variables changes from first grade to third grade. In first grade phonemic awareness has the more powerful effect indicating at this level spelling is more of a sequential, encoding process. By third grade most children may have acquired the modicum of phonemic awareness required to get them started spelling. (The low phonemic awareness group in grade 3 is very close to the high, grade 1 phonemic awareness group.) By grade 3 word-specific information exerts the stronger influence on spelling, suggesting children at this level spell using memorized associations.

The patterns of the scattergrams were particularly interesting. These indicate that phonemic awareness is the foundation for the development of word-specific information. While there were children who were high in phonemic awareness but low in word-specific information, there were <u>not</u> children who scored high in word-specific information in the absence of phonemic awareness. If children do, in fact, learn the spelling of a word by matching letters to phonemic segments in the word, then it appears that access to a word at its phonemic level facilitates this process. The nature of the word-specific

information task was such that the ambiguous spelling was one phonemic "slot" (cf Ehri, 1980) in the word; all other phoneme spellings were held constant. Since the words were pronounced for the students, eliminating the need for any phonological processing, they had only to recall the specific spelling for the ambiguous phoneme in the word. The scatterplots indicate that children most proficient at this task were also scoring high on the phonemic awareness test. Furthermore, those scoring low on the phonemic awareness test were <u>not</u> proficient at the word-specific information task.

Finally the qualitative analyses show how each of these underlying skills (i.e., phonemic awareness and word-specific information) support spelling ability. Children who are high in phonemic awareness are better prepared to complete the internal analysis of a word. When reading they have the capacity to focus their attention on individual phonemes in words. During spelling they can completely segment a word into its constituent phonemes, allowing them more opportunity to represent these phonemes in print. As children's word-specific information increases they fare better at spelling phonemes having more than one logical graphemic pattern.

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Table 1

Descriptive Statistics

	Grade			
	1		3	
Variable	Mean	Standard Deviation	Mean	Standard Deviation
Spelling	7.8	4.7	23.7	7.1
Phonemic Awareness	20.0	9.9	32.2	6.1
Word-Specific Information	4.2	8.2	30.5	12.8

Table 2

Intercorrelations of All Variables

Variable	1	2	3
1. Spelling		.67*	.52*
2. Phonemic Awareness	.57*		.38*
3. Word-Specific Information	.80*	.45*	

*p<.05

Note: Numerals above the diagonal are for the first grade students, and those below are for the second-grade students.

Table 3

Percent of Consonants Correctly or Logically Represented in Incorrect Spellings

	Grade			
	1		3	
Word	Low Phonemic Awareness	High Phonemic Awareness	Low Phonemic Awareness	High Phonemic Awareness
hospital	46	82	73	100
community	80	81	70	98
contest	43	72	70	80
sandwich	50	77	80	100
appliance	43	83	75	94

Note: Data are reported as averages.

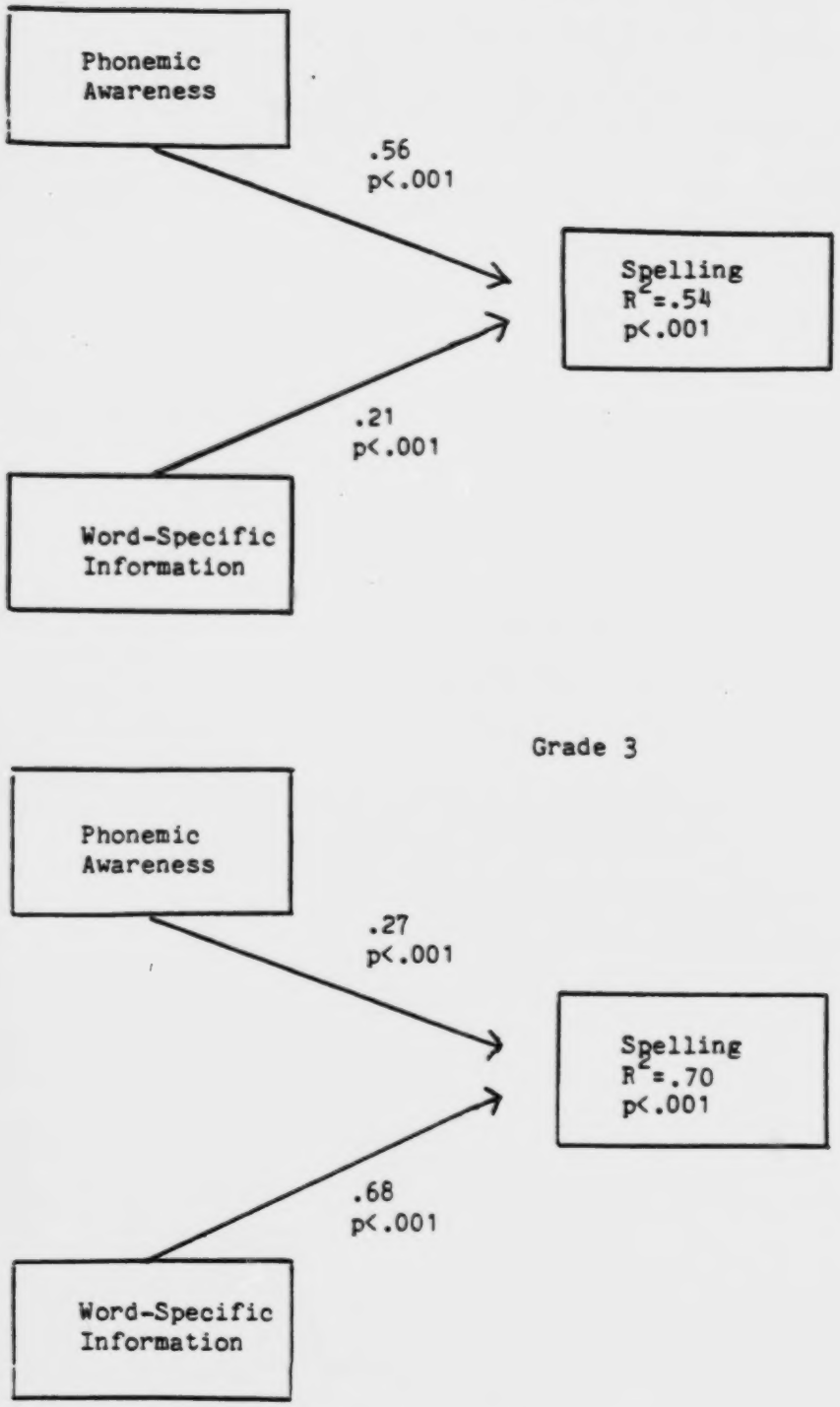

Figure 1. Results of regression analysis for each grade. (Standardized beta weights are shown on each path.)

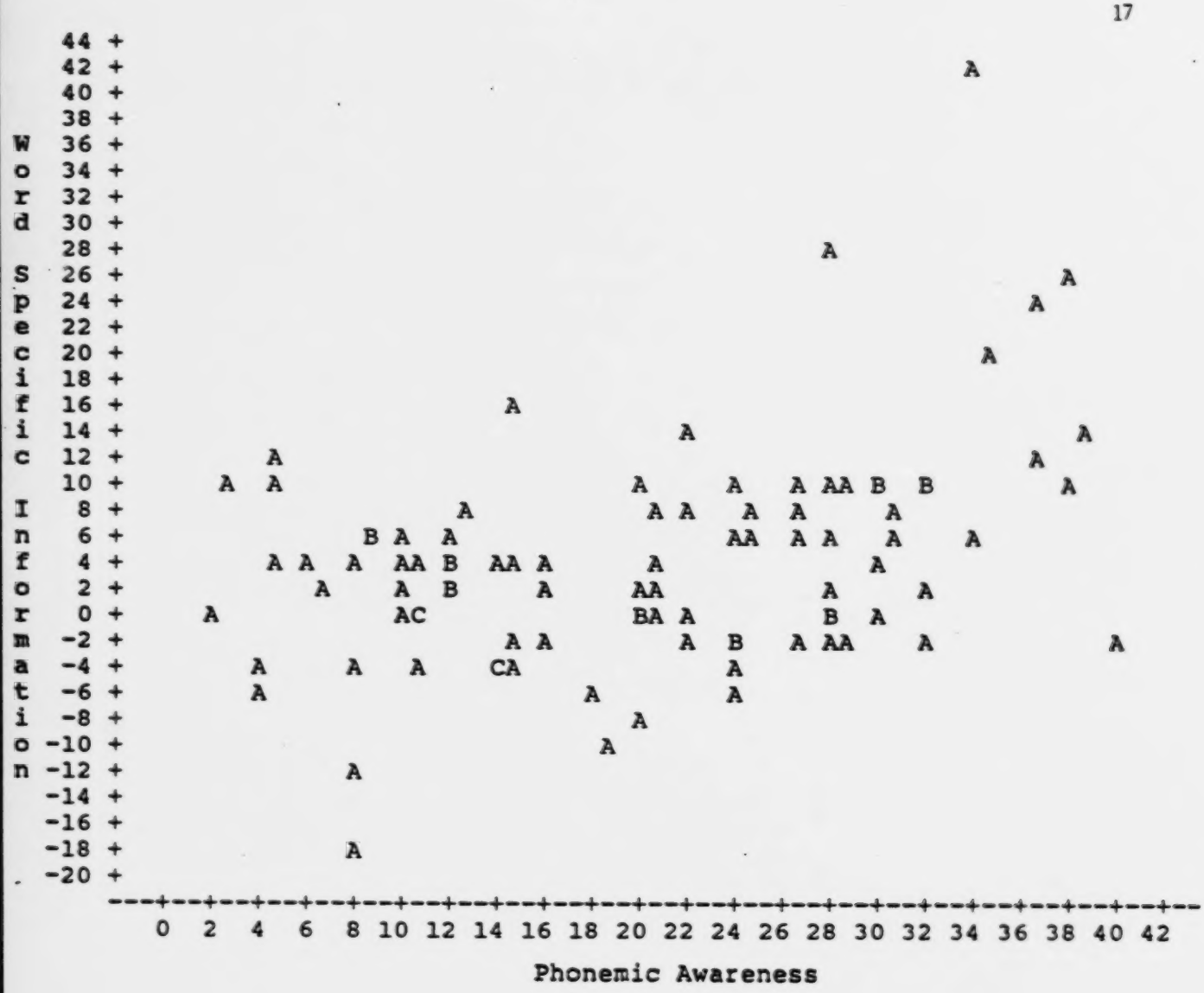

Figure 2. Relationship between word-specific information and phonemic awareness in first grade. (Legend: A=1 obs, B=2 obs, etc.)

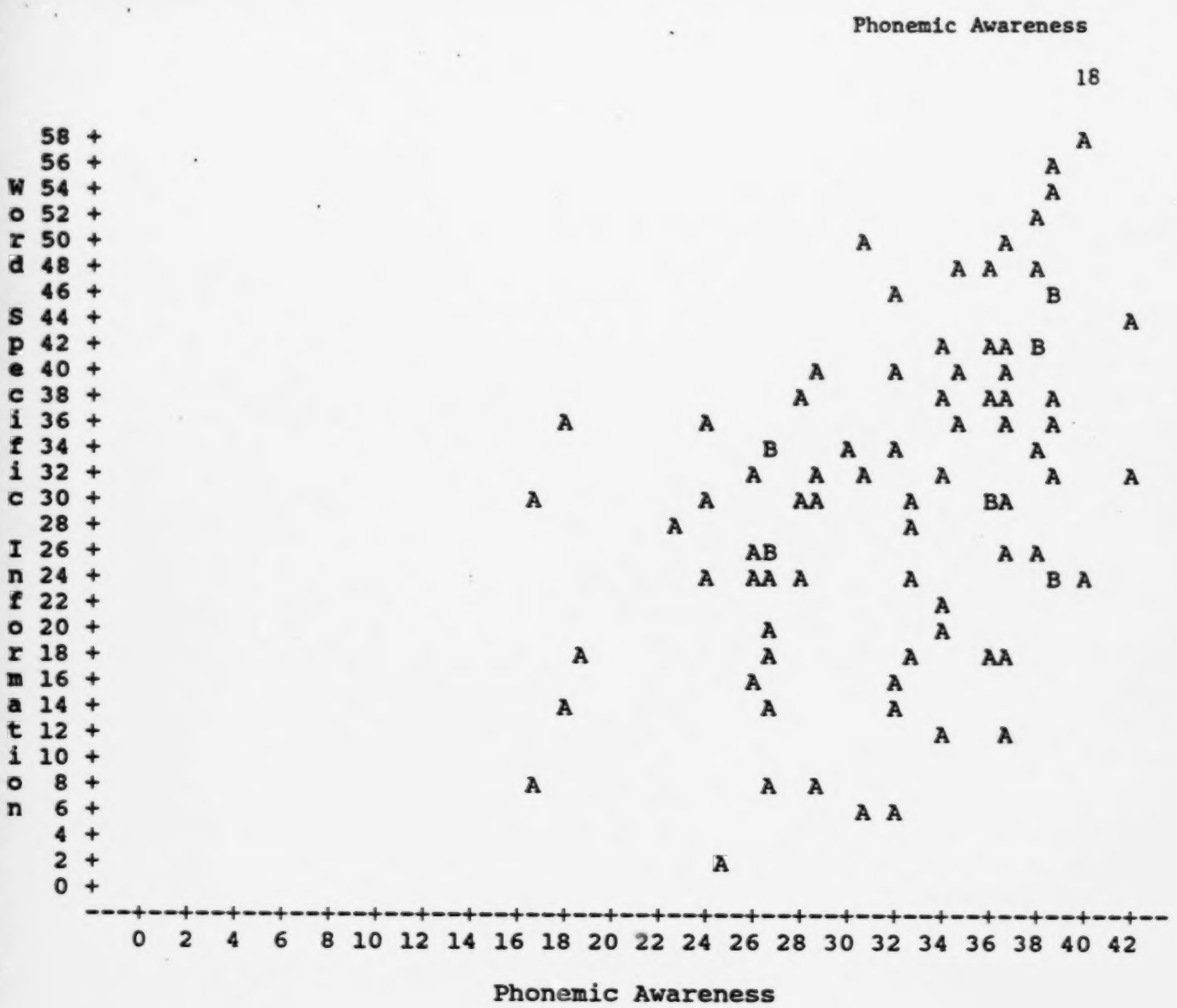

Figure 3. Relationship between word-specific information and phonemic awareness in third grade. (Legend: A=1 obs, B=2 obs, etc.)

Hospital

Grade 1, Low(<10) Phonemic Awareness N=19	Grade 3, Low(<26) Phonemic Awareness N=10	Grade 1, High(>30) Phonemic Awareness N=18	Grade 3, High(>38) Phonemic Awareness N=13
h	hospital	hspetl	hospital (10)
hspt	hositpor	hospittoo	hospitle (2)
ho	hospoltool	hospito	hosptale
hecrq	hospita	hosppitl	
haspl	housposs	hosputut	
hemt	hdit	hospto	
hodd	hosplie	hospet	
hopaol	hoptlile	hospetel	
hspto	hosptil	hospitl	
hopat	hopr	hpitl	
hospetor		hosspitel	
hs (2)		hospitoll	
hptl		hosptl	
hoebuou		hospilo	
hopl		hosdist	
hosbts		hospelad	
hobebeda		isptl	
hopti		hospl	

Figure 4. Spellings of hospital produced by high and low phonemic awareness groups in each grade. Note: Numbers in parenthesis following a spelling indicate the number of children producing the spelling.

Community

Grade 1, Low(<10) Phonemic Awareness N=19	Grade 3, Low(<26) Phonemic Awareness N=10	Grade 1, High(>30) Phonemic Awareness N=18	Grade 3, High(>38) Phonemic Awareness N=13
k	camty	crmute	community (2)
kt	comtey	kmut	commity
kmt	comentey	cumpe	coumunity (2)
kcneq	cmmt	cumute	comunity (2)
cmt	comtear	kimte	cumenty
cmnt	kumte	cuomuta	comminty
cpct	coutre	cmnt	cumnte
cme	qumite	qomunety	commnete
cmte	cyose	cmuat	cumoonate
cnnt	cunte	kmnte	comunty
cmnte		comunete	
ctee		cumyouatee	
cst		kununte	
cetm		kmute	
cvnuto		c ne	
gmt		cmtndt	
homlesot		cumunt	
cmde		cut	
cqut			

Figure 5. Spellings of community produced by high and low phonemic awareness groups in each grade. Note: Numbers in parenthesis following a spelling indicate the number of children producing the spelling.

Contest

Grade 1, Low(<10) Phonemic Awareness N=19	Grade 3, Low(<26) Phonemic Awareness N=10	Grade 1, High(>30) Phonemic Awareness N=18	Grade 3, High(>38) Phonemic Awareness N=13
k	contest (4)	contest (8)	contest (12)
kt	contast	kotel	conts
c	contes (2)	cottel	
cot (5)	crtest	conteat	
cots	cint	crtes	
cats	cor	cont	
cits		kontest	
kiet		kotesttest	
kit		cnsta	
ctas		cots	
cotas		contes	
oths			
gtes			
hotss			
gotas			

Figure 6. Spellings of contest produced by high and low phonemic awareness groups in each grade. Note: Numbers in parenthesis following a spelling indicate the number of children producing the spelling.

Sandwich

Grade 1, Low(<10) Phonemic Awareness N=19	Grade 3, Low(<26) Phonemic Awareness N=10	Grade 1, High(>30) Phonemic Awareness N=18	Grade 3, High(>38) Phonemic Awareness N=13
s	sandwich (4)	sandwich (4)	sandwich (8)
swt	sandwish (2)	sanwich (2)	sandwitch (4)
sw	sanwish	sanwech	sanwich
sewh	smanit	samwech	
sawo	sh	sandwick	
cwt	saiw	sawech	
syi		sanwihs	
sawh		sagwish	
sws		somwisln	
sawek		sawetc	
sagwehs		sandws	
sd		shawe	
sawi		sawch	
shewsh		sawh	
saw			
sag			
sawhn			
sawet			
sawc			

Figure 7. Spellings of sandwich produced by high and low phonemic awareness groups in each grade. Note: Numbers in parenthesis following a spelling indicate the number of children producing the spelling.

Appliance

Grade 1, Low(<10) Phonemic Awareness N=19	Grade 3, Low(<26) Phonemic Awareness N=10	Grade 1, High(>30) Phonemic Awareness N=18	Grade 3, High(>38) Phonemic Awareness N=13
a	aplase	plays	appliance
l	aplanse	niplins	applance
td	polsty	upiler	apliance (2)
wievhr	aplanen	plinse	apints
apins	unplanee	apleints	apins
tnme	pilit	plins	uplance
pin	aplar	opins	appinence
aps	undaple	apliens	aplinc
opn	unplons	plince	aplyance
pies	lpise	aplisce	aplince
aloyes		aplience	aplience
ple		aplints	aplance
als		aples	
psh		pliese	
fln		apline	
apals		apis	
aopo		aplies	
plons		aplis	
plli			

Figure 8. Spellings of appliance produced by high and low phonemic awareness groups in each grade. Note: Numbers in parenthesis following a spelling indicate the number of children producing the spelling.

	Word-Specific Information	
Word	Low N=6	High N=5
when	win (3) wen (2) wind	when (2) win (2) wean
this	this thes htis tis tes (2)	this (4) thes
what	what whot wot (2) wut woat	what (4) whot
duck	duc (2) doc (2) bok duak	duck (4) duke

Figure 9. Compilation of the spelling of first grade children high in phonemic awareness but high or low in word-specific information. Note: Numbers in parenthesis indicate the number of times each spelling was produced. Ambiguous parts of words are underlined.